No. 663,799. Patented Dec. 11, 1900.

H. H. VAUGHAN.

MOTIVE FLUID DRILL.

(Application filed Dec. 6, 1899.)

(No Model.) 4 Sheets—Sheet 1.

Fig. 2.

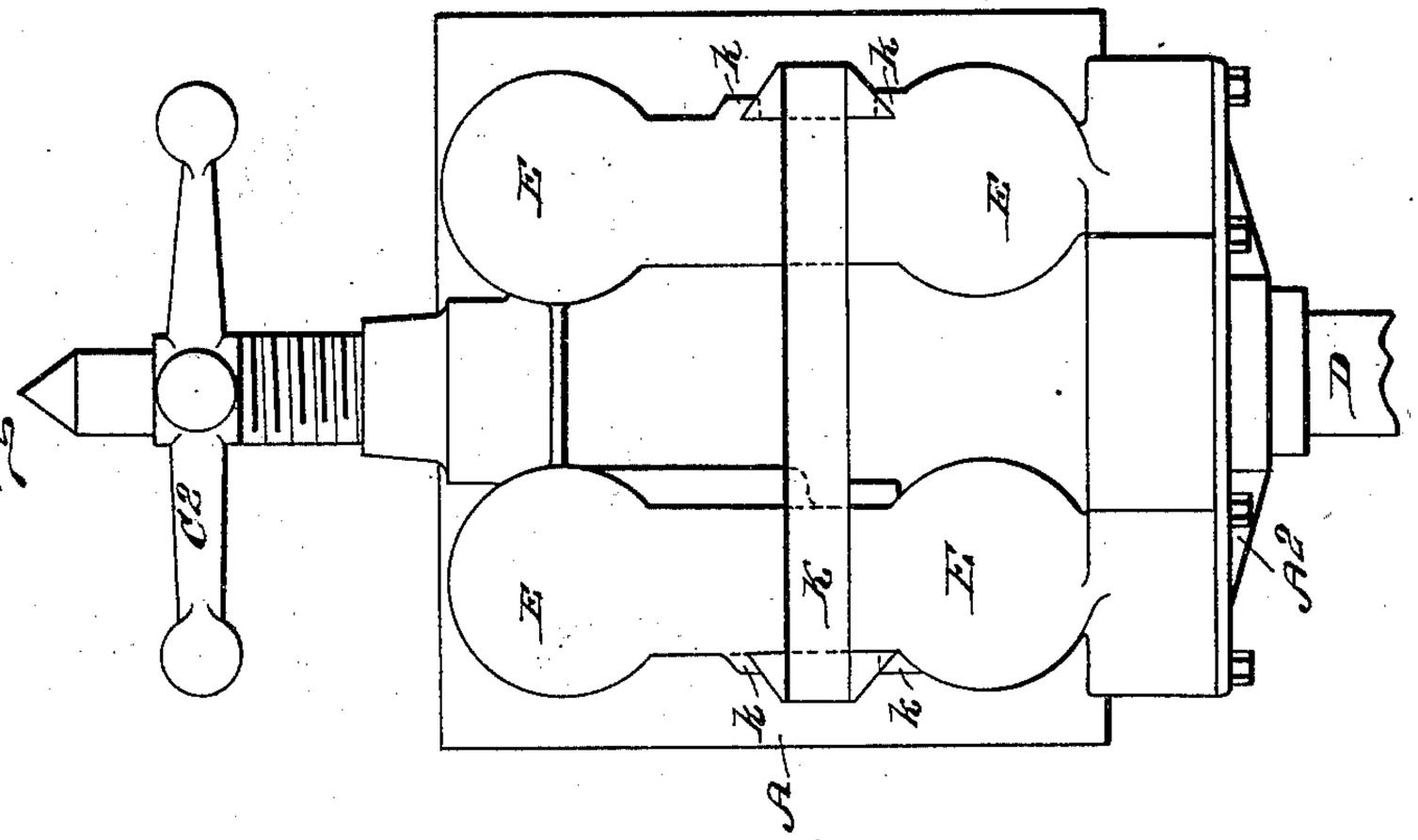
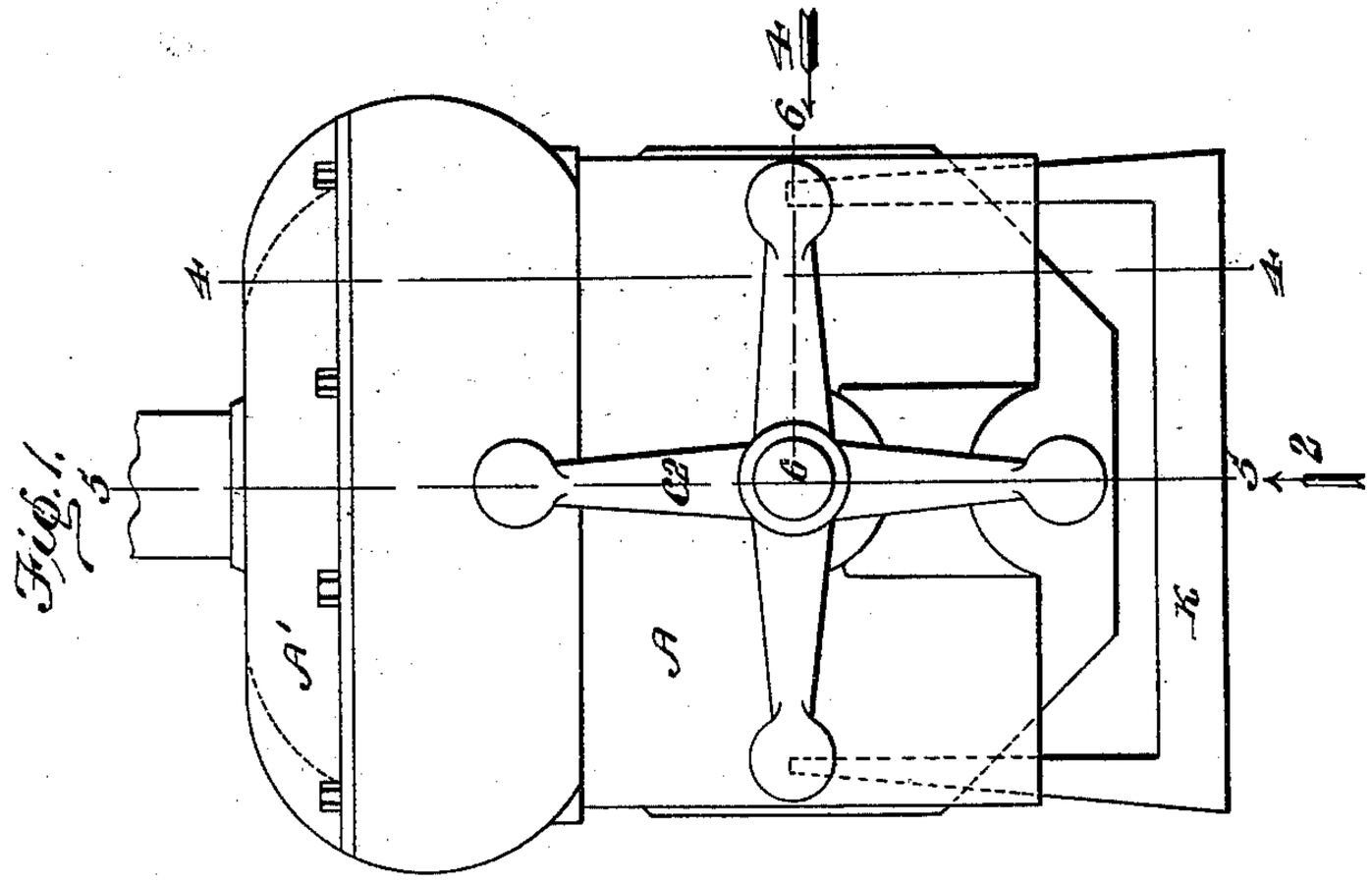


Fig. 1.



Witnesses:
J. McFowler Jr.
On. Darley.

Inventor:
Henry H. Vaughan
by F. W. Ritter Jr.
Attorney

No. 663,799. Patented Dec. 11, 1900.

H. H. VAUGHAN.

MOTIVE FLUID DRILL.

(Application filed Dec. 6, 1899.)

(No Model.) 4 Sheets—Sheet 2.

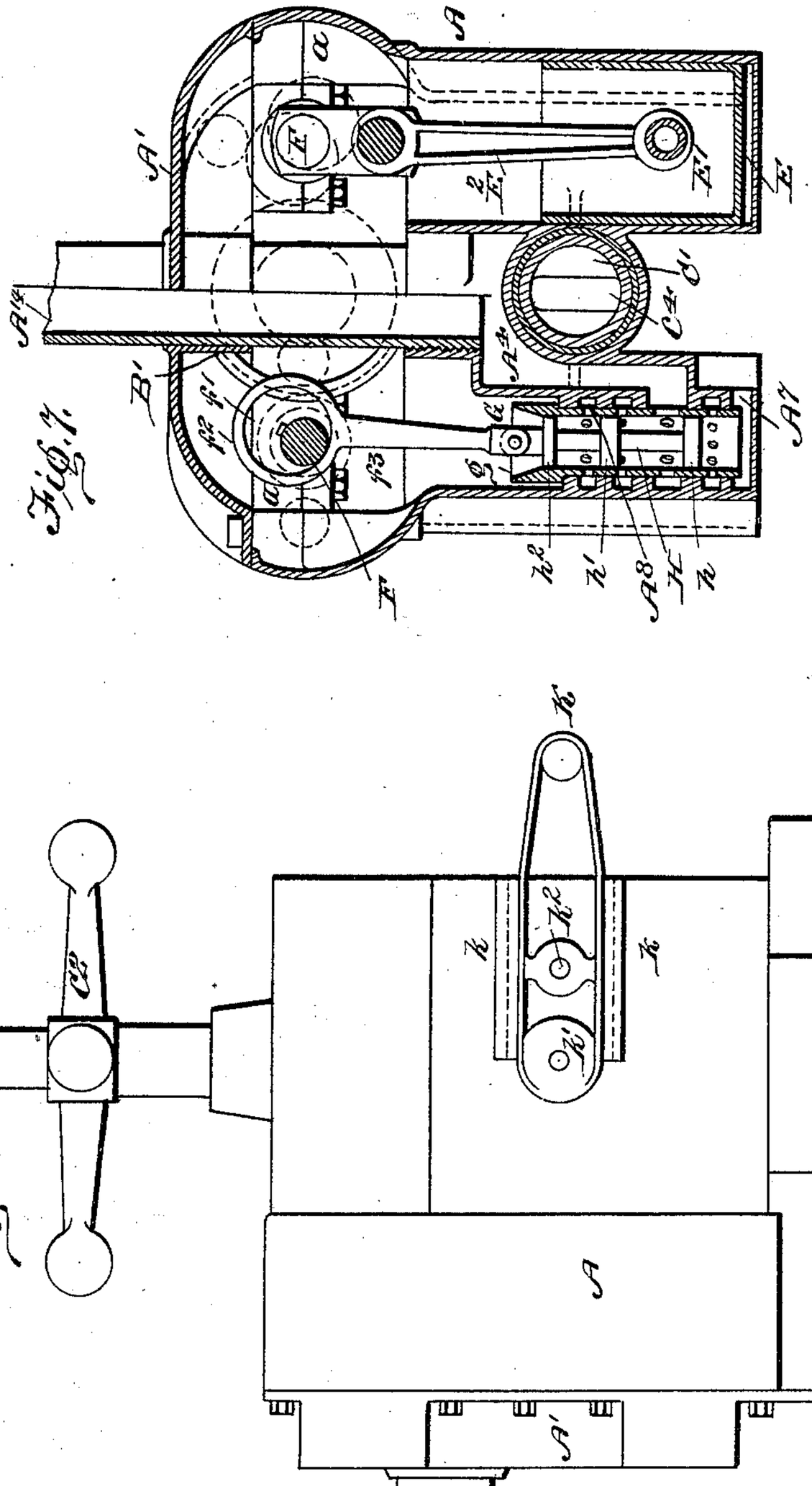


Fig. 4.

Fig. 5.

Witnesses:
J. M. Fowler Jr.
M. Darley.

Inventor:
Henry H. Vaughan
by F. W. Ritter Jr.
Attorney.

No. 663.799.

Patented Dec. 11, 1900.

H. H. VAUGHAN.

MOTIVE FLUID DRILL.

(Application filed Dec. 6, 1899.)

(No Model.)

4 Sheets—Sheet 3.

Fig. 3.

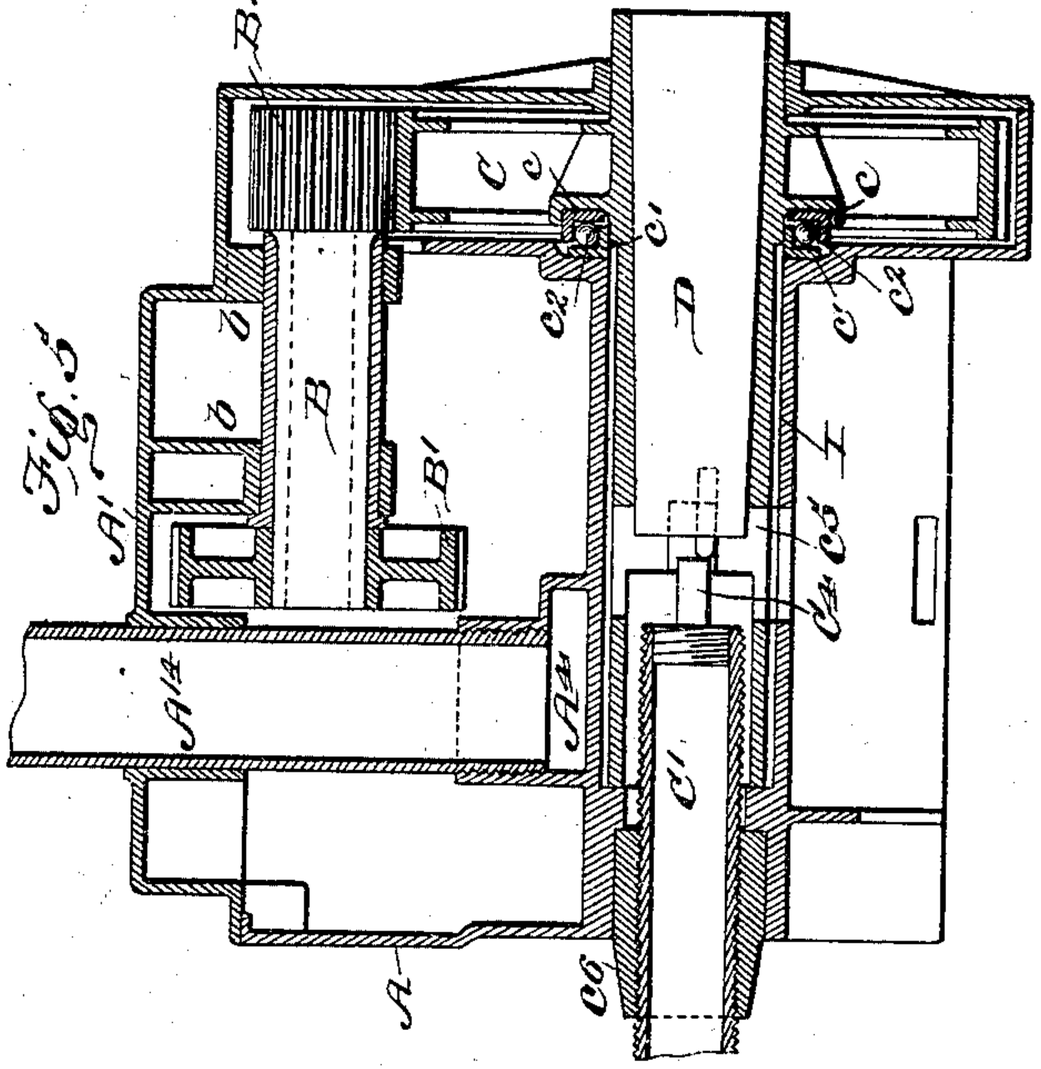
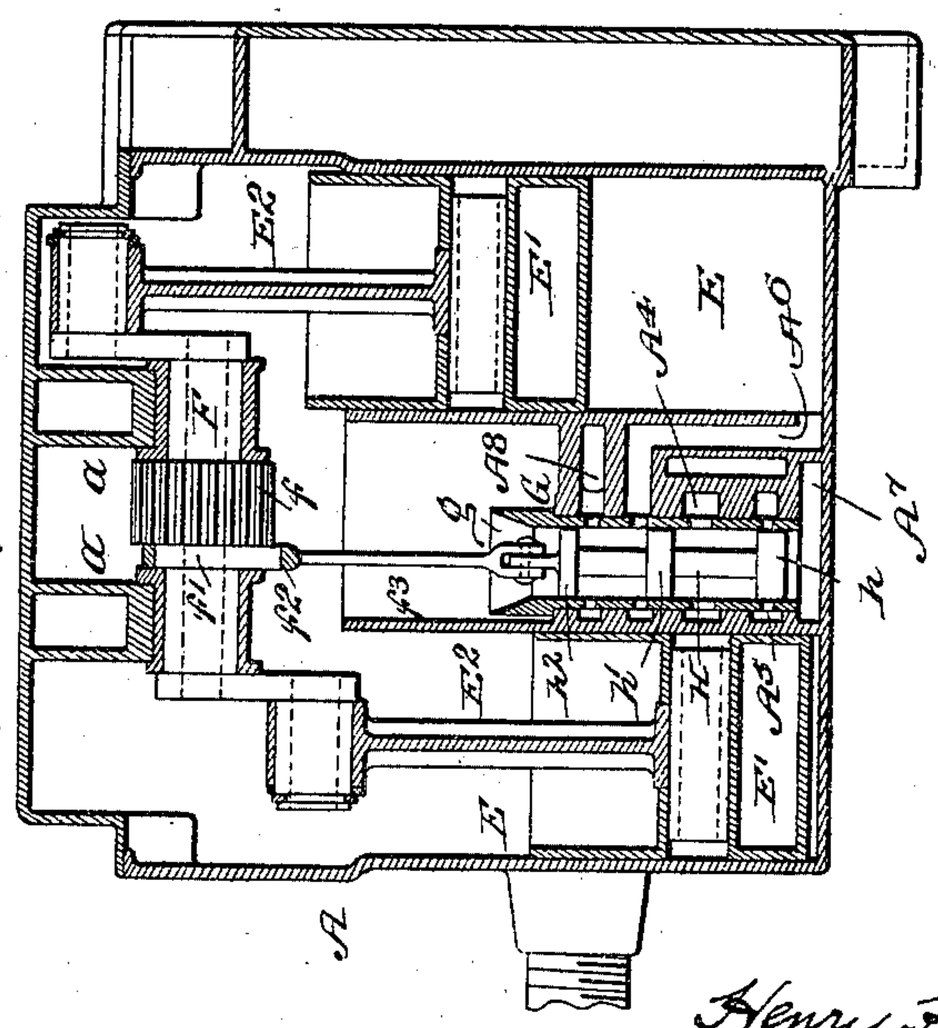


Fig. 4.



Witnesses:
J. M. Fowler Jr.
M. Darley.

Inventor:
Henry H. Vaughan
by F. W. Ritter & Co.
Attorney.

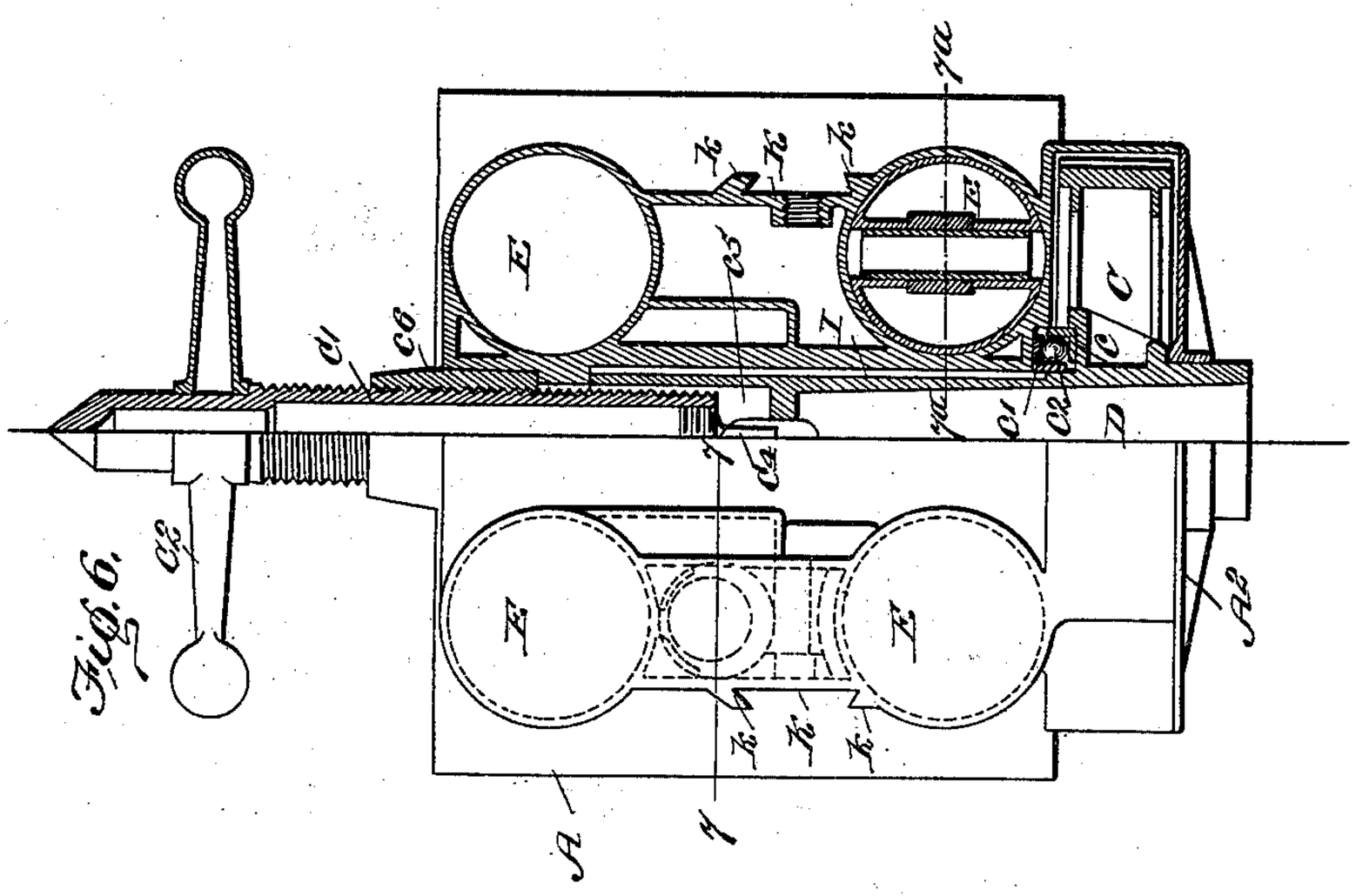
No. 663,799. Patented Dec. 11, 1900.

H. H. VAUGHAN.

MOTIVE FLUID DRILL.

(Application filed Dec. 6, 1899.)

(No Model.) 4 Sheets—Sheet 4.



Witnesses
J. McF. Fowler Jr.
Wm. Darley.

Inventor:
Henry H. Vaughan
by F. W. Ritter Jr.
Attorney

UNITED STATES PATENT OFFICE.

HENRY H. VAUGHAN, OF CHICAGO, ILLINOIS, ASSIGNOR TO CHARLES F. QUINCY, OF SAME PLACE.

MOTIVE-FLUID DRILL.

SPECIFICATION forming part of Letters Patent No. 663,799, dated December 11, 1900.

Application filed December 6, 1899. Serial No. 739,399. (No model.)

To all whom it may concern:

Be it known that I, HENRY H. VAUGHAN, a citizen of the United States, residing at Chicago, in the county of Cook, State of Illinois, have invented certain new and useful Improvements in Motive-Fluid Drills; and I hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, in which—

Figure 1 is a plan view of a drill embodying my invention. Fig. 2 is an end elevation thereof looking in the direction of arrow 2, Fig. 1. Fig. 3 is a side elevation thereof looking in the direction of the arrow 3, Fig. 1. Fig. 4 is a vertical section taken on the line 4 4, Fig. 1, and looking in the direction of the arrow 4. Fig. 5 is a vertical central section taken on the line 5 5 looking in the same direction as in Fig. 4. Fig. 6 is in part (the left) an end elevation similar to Fig. 2 and in part (the right) a section on the line 6 6 of Fig. 1. Fig. 7 is in part (the left) a section on the line 7 7 of Fig. 6 and in part (the right) a section on the line 7^a 7^a of Fig. 6.

Like symbols refer to like parts wherever they occur.

The object of my present invention is the production of a motive-fluid (pneumatic or steam) drill in which with a master-wheel of the size suitable for any given power or capacity the greatest dimensions of cylinders may be obtained without increasing the distance at which the drill-spindle can be operated from walls or corners.

To this end the main feature of my invention, generally stated, embraces the combination, in a motive-fluid drill, of a plurality of cylinders arranged in parallel relation and a plurality of crank-shafts provided with gearing, a master-wheel, and an interposed shaft provided with gearing which engages the gearing of the crank-shafts and the master-wheel, whereby a master-wheel of maximum diameter may be employed with any given power without unduly increasing the projection of the drill-case.

A secondary feature of my invention consists in supporting the crank-shaft bearings from the case-cap, whereby upon the removal of the cap the whole interior of the casing is rendered readily accessible.

There are other minor features of invention, all as will hereinafter more fully appear.

I will now proceed to describe my invention more fully, so that others skilled in the art to which it appertains may apply the same.

In the drawings, A indicates the case, closed at one end by a detachable cap A′, provided on its interior with suitable bearings *a a* for crank-shafts, (see Fig. 4,) which in the present instance will be four in number, there being two crank-shafts, to each of which two pistons are coupled, and intermediate of said bearings other bearings *b b* (see Fig. 5) for the shaft B, which is interposed between the crank-shafts and the master-wheel C of the drill. The bottom of case A is also closed by a cap-plate A^2, which holds the master-wheel C in the case and through which projects the drill-spindle D.

E E E E indicate a plurality of cylinders formed within the case—in the present instance four—arranged in parallel relations, each cylinder having a suitable piston E′, provided with a bearing through which and through an eye on the end of pitman E^2 passes a suitable pin for forming a pivot or joint connection between said parts. By means of said pitman each two of said pistons are coupled with a common crank-shaft F, the cranks whereof are preferably placed opposite each other and at an angle of ninety degrees (90°) to the cranks of the other shaft, or shaft with which the second pair of pistons are coupled. The crank-shafts F (see Fig. 4) are each provided, preferably at a point intermediate of their bearings, with a gear-wheel *f* and with an eccentric *f′*, having an eccentric-strap f^2 and rod f^3 (the rod and strap being preferably integral) for actuating the valve which controls the admission and exhaust of the motive fluid to the two cylinders whose pistons are coupled to said crank-shaft. Interposed between or intermediate of the cylinders to be controlled thereby is located the valve-chamber G, (see Fig. 4,) provided with an induction-passage A^4, (see Figs. 5 and 7,) which connects with the motive-fluid pipe A^{14}, with induction-ports A^5 A^6

(see Fig. 4) leading to the cylinders, and exhaust-ports A^7 A^8 (see Figs. 4 and 7) leading from said cylinders. It will be noted that the exhaust-port A^8 is divided from the crank-shaft chamber by a wall or partition. The pipe A^{14} is provided with a suitable throttle-valve for controlling the admission of the motive fluid to the valve-chambers.

The walls of the valve-chamber G and its several ports are formed as a seat for the inserted valve-casing *g*, having corresponding ports and adapted for the reception of the piston-valve H, which is actuated from the crank-shaft F by means of the eccentric strap and rod f^2 f^3. The piston-valve H is of the usual type in so far as it receives the motive fluid between the heads *h h'*, but varies therefrom in that it is provided with an additional collar or piston-head h^2, (see Figs. 4 and 7,) the object of which is to close the end of valve-casing *g*, and in conjunction with the wall which separates the exhaust-port A^8 from the crank-shaft chamber prevent the motive fluid from exhausting into the crank-shaft chamber, and also prevent any lubricant from the bearings of the crank-shaft being carried out through the exhaust-ports.

As previously pointed out, the construction chosen for illustration embraces four cylinders (see Figs. 2 and 6) having their pistons coupled to two parallel crank-shafts, the cranks of one shaft set at an angle of ninety degrees (90°) to those of the other shaft and each shaft provided with a gear-wheel *f*. The gear-wheels *f f* of the crank-shaft F each mesh with a gear-wheel B' on one end of an interposed or intermediate shaft B, (see Figs. 5 and 7,) supported from the cap A' in suitable bearings, the opposite end of said shaft B being provided with a pinion B^2, which meshes with the master-wheel C, which is mounted on and drives the drill-spindle D, the drill-spindle and its feed-screw being located parallel with the crank-shafts and intermediate shaft B, but at right angles to and intermediate of the cylinders, (see Figs. 5, 6, and 7,) whereby great compactness is obtained without sacrifice of power.

I indicates the bearing for the drill-spindle D and its feed-screw C', (see Fig. 5,) said bearing extending transversely of the case and substantially in the median line thereof.

The master-wheel C is attached to the spindle D, and preferably is formed integral therewith, and at its inner side is provided with a collar or ball-race *c*, for which there is a corresponding collar or ball-race *c'* opposite thereto on the bearing, and interposed balls c^2, the whole constituting a ball-bearing to take up the end thrust due to pressure on drill-spindle D. When inserted in the bearing, the spindle D and master-wheel C are retained by the application of the cap-plate A^2. The outer end of the drill-spindle is provided with the usual drill-socket, and a central hole or bore passes therefrom to the inner end of the spindle (see dotted line, Fig. 5) for the reception of the reduced portion C^4 on the inner end of the feed-screw, so that the feed-screw C' may be used to force the drill from the drill-spindle when necessary. For a like purpose a lateral opening c^5 is cut in the side of the spindle D (see Figs. 5 and 6) and a corresponding hole or slot in the spindle-bearing I, into which a wedge may be driven to dislodge the drill-tool. C' indicates the feed-screw, also arranged in the bearing I and adapted to bear on the inner end of the drill, the outer end of said bearing being provided with a nut c^6, through which the feed-screw passes. The feed-screw is provided with a hand-wheel or handle C^2, as shown in Figs. 1, 2, 3, and 6.

The motive-fluid pipe A^{14} serves as a handle for moving the drill-case, and in addition thereto a handle K is provided on the opposite side of the drill-case, (see Figs. 1, 3, and 6,) which handle slides in and out in dovetail guides *k*, so as to be pushed within the line of the projecting portion of the master-wheel case when required for drilling in corners or close to walls, and said sliding handle K is held in fixed position either in or out by yielding or spring pins *k' k²*, which can be pushed in to permit the sliding back and forth of the handle.

In assembling the parts the intermediate shaft B and the crank-shafts F may be secured in the appropriate bearings *a a* on the inner face of the cap A', the pistons and valves properly connected with the crank-shafts, and the valve-casing *g* inserted within the valve-chamber of the case, after which the application of the cap A' to the case will complete the assembling of the motor, while the simple removal of the cap will result in the withdrawal of the attached parts and give free access to the interior of the case, as well as facilitate any repairs that may be required. Likewise the feed-screw C' may be readily inserted through the proper opening in the case, and the drill-spindle D and master-wheel B having been inserted the application of the cap-plate A^2 closes the master-wheel chamber and retains the parts in working position. The removal of cap A' and cap-plate A^2 therefore permits of free access to the interior of the entire drill-case and facilitates the repair of the drill when necessary. It will also be noted that the relative arrangement of the cylinders and the crank-shafts, the intermediate gearing, and the drill-spindle intermediate of the cylinders results in confining the cylinders or case on three sides within the line of projection of the master-wheel, and thus enables me to obtain the maximum of power with the largest master-wheel consistent with the locations in which the drill is to be operated.

Air, steam, or other suitable motive power may be used in operating the drill and will be admitted through induction-pipe A^{14}, thence through ports A^4 and A^5 to the respective cylinders of the coupled pair, and will

escape from the cylinders by the exhaust-ports A^7 A^8, operating crank-shaft F, the intermediate shaft B, and the drill-spindle through the master-wheel C.

As hereinbefore noted, four cylinders are shown in the drawings; but as the construction, coupling-up, and operation of the second pair of cylinders are identical with that described the description, for sake of brevity, has been confined to a single pair of cylinders and their adjuncts.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a motive-fluid drill, the combination with a plurality of cylinders arranged in parallel relation, of a plurality of crank-shafts each of said crank-shafts having a gear-wheel, a drill-spindle provided with a master-wheel, and an intermediate shaft provided with gears which mesh with the crank-shaft and master-wheel; substantially as and for the purposes specified.

2. In a motive-fluid drill, the combination of four cylinders arranged in parallel relation, a crank-shaft for each pair of said cylinders said crank-shafts provided with suitable gear-wheels, a drill-spindle intermediate of the cylinders, a master-wheel, and an intermediate shaft provided with a gear-wheel which meshes with the gear-wheels of the two crank-shafts and with a pinion which meshes with the master-wheel; substantially as and for the purposes specified.

3. In a motive-fluid drill, the combination with a plurality of cylinders arranged in parallel relation, of a plurality of crank-shafts each of said crank-shafts provided with a gear-wheel, a drill-spindle supported in bearings intermediate of the cylinders and provided with a master-wheel, and an intermediate shaft which transmits the power from the crank-shafts to the master-wheel; substantially as and for the purposes specified.

4. In a motive-fluid drill the combination with a plurality of cylinders arranged in parallel relation, of a detachable cap common to all of said cylinders and provided on its inner face with a crank-shaft bearing, and a crank-shaft journaled in the bearing on the inner face of the cap, and removable with said cap, substantially as and for the purposes specified.

5. In a motive-fluid drill, the combination with a plurality of cylinders assembled in parallel relation, of a detachable cap common to all of said cylinders and having on its inner face a series of bearings for a crank-shaft and a transmitting-shaft, and a crank-shaft and a transmitting-shaft journaled in the bearings on the inner face of the cap and removable with the cap, substantially as and for the purposes specified.

6. In a motive-fluid drill, the combination with a plurality of cylinders assembled in parallel relation, of a drill-spindle intermediate of said cylinders, a detachable cap common to all of said cylinders and provided on its inner face with bearings for a crank-shaft and a transmitting-shaft, a crank-shaft and a transmitting-shaft journaled in the bearings on the inner face of said cap and removable therewith, a master-wheel on the drill-spindle, gearing with the transmitting-shaft, and a detachable cap or closure for the master-wheel and spindle-chamber, substantially as and for the purposes specified.

7. In a motive-fluid drill, the combination with a plurality of cylinders arranged in parallel relation, of a detachable cap common to all of said cylinders and provided with a crank-shaft bearing, a crank-shaft journaled in said bearing of the cap and removable therewith, a drill-spindle, and means for actuating the drill-spindle from the crank-shaft, substantially as and for the purposes specified.

8. In a motive-fluid drill having a case, cylinders mounted in said case, a crank-shaft, a detachable cap connected to said case and provided on its inner surface with crank-shaft bearings, the crank-shaft journaled in said bearings and removable with the detachable cap, substantially as and for the purposes specified.

In testimony whereof I affix my signature, in presence of two witnesses, this 4th day of December, 1899.

HENRY H. VAUGHAN.

Witnesses:
D. KISTER,
C. J. FORSBERG.